Synthetic Components Network SCN Logo
Synthetic Biology: from the bottom up

SCN SPRING DISCSSSION MEETNIG
Corpus Christi, Oxford
15th – 16th April 2010

ATTENDEES

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THURSDAY 15TH APRIL

17:00 – 18:00	Arrivals and tea / coffee	Junior Common Room
18:00 – 19: 00	Setting the agenda*	Rainolds Room
19:30 – 21:00	Dinner	Senior Common Room
21:00 – late	Wander around the College and on to the pub *(optional)*	

FRIDAY 16TH APRIL

From 08:15	Breakfast	Tudor Hall
09:00 – 10:30	Discussion session 1	Rainolds Room
10:30 – 11:00	Tea / coffee	Junior Common Room
11:00 – 12:30	Discussion session 2	Rainolds Room
12:30 – 14:00	Lunch	Tudor Hall
	(MC meeting – MC only)	*t.b.c*
14:00 – 15:30	Discussion session 3	Rainolds Room
15:30 – 16:00	Wrap up and close	Rainolds Room

***** We are asking you to set the agenda for this meeting. During this pre dinner session you will have the opportunity to suggest topics for the discussion sessions on Friday. Please bring your ideas, and feel free to bring slides if there's data / images / etc you'd like to show people. We need to identify champions to lead activity here so please do guide the agenda any way you wish.

The objective of this event is to identify potential joint proposals for development over the next 12 to 18 months. These can be pump primed with the researcher exchanges: http://www.bris.ac.uk/scn/exchange/

SUMMARY

A meeting for the PIs of the SCN was arranged with the specific objective of identifying collaborative projects that could be developed into grant applications. The agenda was kept purposefully open (see above), and all PIs were asked to bring one of two ideas to table at the discussion meeting.

PIs from 9 of the SCN's partner institutions attended, spanning the disciplines of Biochemistry, Chemistry, Engineering, Modelling, Physics, Public Engagement and Social Science. We also welcomed a new SCN member adding Bioinformatics to the catalogue of expertise at the meeting.

The open nature of the agenda was demanding, and highlighted the challenges still apparent of working across disciplines, cultures and institutions, even for a group that is becoming well established. However, the group worked hard to find common goals between their ideas, and identify synergistic pathways to achieving these goals.

Three main themes emerged for further development and discussion. These will go on to form the framework of the 2010 SCN Annual Conference.

Emerging ideas

1. In vivo mobile concentrators/distributors

2. Dynamics and movement of droplets/vesicles etc

3. Components and biomaterials

SETTING THE AGENDA – AREAS FOR FURTHER DISCUSSION

The whole group attended this session. Using a divergent brainstorming facilitation technique, all attendees were asked to suggest at least one idea for further discussion. According to converging principles these ideas were then grouped into the five main themes as below.

COMPONENTS

Peptide components
Functional / moving components
Membrane / cytoskeletal components
Novel proteins and peptides

ASSEMBLY

Cytoskeletal interactions with membranes
Evolving DNA assemblages
Enzyme complexes
Enzymatic control of peptide complex assembly
Connecting protocells – cytoskeletons
Understanding control of self assembly
Movement and assembling components

ENCAPSULATION

Protocells
Membrane encapsulation
Control of mechanical responses of structures: dynamic membrane / vesicle structures
Bioenergetics of protocells
Confinement in encapsulated spaces

FUNCTION

Biomimetic elastomers
Protein plasticity and novel functions
Unnatural amino acids and novel properties
Functional nano-structures
Molecular motors

APPROACHES

Machine learning / uncertainty
Social Science lab placements
Modelling / prediction
Social science contribution to Synthetic Biology
Experimental approaches to build large complexes in membranes
Catalysis and de novo enzyme design
Molecular biology
Ethics / regulation
Simulation of cell dynamics
Prediction of protein folding / assembly in membranes
Protocellular systems to test our components / hypotheses

DISCUSSION SESSION 1

The whole group attended this session. The objective was to identify at least one specific project that could be addressed using the expertise and approached identified in the 'Setting the agenda' session.

A topic was proposed, from which the group went on to discuss potential research questions, methodology, outcomes and impact.

Proposal: Prototissues from droplets and protocell systems

- Desirable properties of a protocell
- What's missing?
- Established droplet systems

Discussion:

- Droplets versus vesicles
- Potential functions
- Making it work

Potential project: in vivo, mobile, concentrator

- A biotin concentrator for proof of principle, with streptavadin inside the vesicle
- Should challenge/interface synthetic systems with biological systems, to achieve in vivo sensing
- Encorporate ideas from other encapsulation systems
    - Viruses and VLPs
    - Clathrin coated vesicles

DISCUSSION SESSION 2 – BREAK OUT 1: IN VIVO, MOBILE, CONCENTRATOR

For the second discussion session the group split into two break-out groups.

BREAK OUT 1: IN VIVO, MOBILE, CONCENTRATORS, DISTRIBUTORS AND SENSORS

- What are the essential components of such a system?
- Motion – what's required and how can this be provided?
    - A propeller system?
    - How would we create specificity in the tethering region
    - Can we exploit droplet interfaces?
- What are the challenges?
- Is the Chlamydomonas (algae) a useful model?

- What would act as the energy source
- Are there alternative models
- What are the enabling technologies
- Are there useful robotics approaches
- How wouold we test the model

BREAK OUT 2: COMPONENTS, BIOMATERIALS AND REDUCING BIGGER PROBLEMS TO PRACTICE

Emerging idea: The notion of modularity and the question: can biology be reduced to components? Or, can we solve the protein folding protein for a series of peptide modules, as has been done for DNA and RNA?

Potential solutions:

- Making hybrid materials, e.g. combining DNA facile self-assembly and protein/peptide functional assembly.
- The Engineering switchable peptides/proteins that harbour both sensing and reporting elements.

DISCUSSION SESSION 3

The group came back together as a whole for this last session. Each break out group briefly summarised their discussions from the previous session.

Each PI was then asked to suggest any emergent ideas from the discussion meeting. These included:

- Expanded genetic code and putting non-natural amino acids into proteins
- Natural and designer self-assembling amyloid systems, and using these to template the assembly/deposition of other materials. Challenges include using the disease state, but this could be circumvented using “natural amyloids” such as hydrophobins etc.
- Applying the power of DNA assembly to other systems, e.g. templating protein assembly, making molecular motors etc.
- Folded-protein systems that potentially make fibres to complement/rival the amyloid and self assembling peptide fibres (SAF) systems. Can these systems be compared and contrasted, and do they do different things?
- In silico protein folding and design. Can we make discrete proteins and materials in a very *ab initio* design way possibly using “yet-to-be-discovered” protein folds?
- Can we make proteins do what they wouldn’t normally do by piecing different natural proteins together?
- Peptide and protein design. Can we can understand protein folding and make truly robust and plug-and-play modules?
- Can we model the behaviour and emergent properties of components we’re designing?
- How far it is possible to modularize and reduce biology to components that can be then used to build new stuff?